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Application for Utility Model Registration

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1. Name of Invention

Abnormality detection device for thermostat

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## SPECIFICATION

### Title of the Utility Model

Abnormality detection device for thermostat

### Claims for the Utility Model

An abnormality detection device for thermostat comprising: a thermostat mounted, in a circulation water path for cooling water used for cooling an engine main body, between the circulation water path for connecting an outlet of the engine main body cooling water circulation path with a radiator; a first temperature detector located at an upstream of the thermostat; a second temperature detector located at a downstream; a first comparator for comparing output from said first and second temperature detectors; a second comparators for comparing an output from the first temperature detector with a preset reference voltage; and an alarm for generating an alarm in response to the output from the first comparator, wherein an alarm is generated when the first comparator outputs while the second comparator outputs.

### Detailed Description of the Utility Model

The present utility model relates to a device for detecting an abnormality in a thermostat which is mounted on a cooling circulation water path in an internal combustion

engine and is used for controlling the cooling water temperature, and for generating an alarm.

In order to keep the engine performance at the optimum level and to keep the engine durability, it is required to control the temperature of the engine main body during operation not to be excessively high and not to be excessively low.

Therefore, a thermostat is normally provided on a path leading to a radiator containing cooling water for cooling the engine main body, thereby keeping the cooling water temperature at a specified value and indirectly controlling the engine main body temperature at an optimum value.

A thermostat is a kind of valve, and operates to open and close a path leading to a radiator by a temperature sensitive member incorporating a member which expands or shrinks when it senses that the cooling water temperature has changed, thereby controlling the temperature. For example, when the cooling water temperature increases, the valve opening becomes larger and the amount of the cooling water flowing into the radiator increases to cool and lower the water temperature. Contrarily, when the cooling water temperature lowers, the valve opening becomes smaller and the amount of the cooling water flowing into the radiator decreases.

With this arrangement, the heat release amount of the cooling water in the radiator is automatically controlled depending on the cooling water temperature, and as a result,

the cooling water temperature is always kept at a value within a specified range.

However, in such a device, if the thermostat becomes inoperable while its valve is in a closed state caused by, for example, the leakage of the expandable or shrinkable member from the temperature sensitive member or occurrence of fault in the valve mechanism, the cooling water temperature increases to an excessively high value. In this case, there is a fear that the engine is over-heated.

The present utility model has been made in view of the circumstances described above, and an objective thereof is to provide a device including a thermistor respectively and independently at an upstream side and a downstream side of a thermostat, that is, an upstream side and downstream side of a main valve of a thermostat provided in an engine block, and for generating an alarm to issue a warning that the thermostat is in an abnormal state when the ratio between the internal resistances of these thermistors exceeds a predetermined value.

Hereinafter, the present utility model will be described with reference to drawings. FIG. 1 is a diagram showing an embodiment of the present utility model. The reference numeral 1 denotes a thermistor as a temperature detector disposed on a cooling water path provided in an engine block, that is, provided at an upstream side of the main valve of the thermostat, and 2 also denotes a thermistor disposed

between the thermostat and the radiator, that is, on a water path at a downstream side of the main valve of the thermostat.

The thermistors 1, 2 are positive characteristic thermistors of which internal resistances increase as the temperature increases, and are a kind of temperature sensors. A thermostat is generally mounted on an engine main body, and is connected with a radiator via a thermostat main valve. The radiator allows the cooling water to release heat to cool the cooling water.

A power supply voltage is applied to the thermistor 1 via a resistor R1, whereas a power supply voltage is applied to the thermistor 2 via a resistor R2.

The voltages at opposite ends of the thermistor 1 are outputted to a positive terminal of a comparator 3, whereas the voltages at opposite ends of the thermistor 2 are outputted to a negative terminal of a first comparator 3.

The first comparator 3 outputs high-level to a base-emitter of the transistor 4 when the voltages at the opposite ends of the thermistor 1 exceed the voltages at the opposite ends of the thermistor 2 to make the transistor conductive. When the voltages at the opposite ends of the thermistor 1 do not exceed the voltages at the opposite ends of the thermistor 2, the first comparator 3 outputs low-level.

The transistor 4 executes a switching operation. When high-level is input into the transistor 4, the transistor 4

makes the collector-emitter conductive. When low-level is input into the transistor 4, the transistor 4 breaks the conduction.

The voltages at the opposite ends of the thermistor 1 are also outputted to a positive terminal of a second comparator 5. Further, a specified reference voltage obtained by dividing a power supply voltage by means of resistors R3, R4 is outputted to a negative terminal of the comparator 5.

The second comparator 5 outputs high-level to base-emitter of a transistor 6 when the voltages at the opposite ends of the thermistor 1 exceeds a specified reference voltage, that is, when the internal resistance of the thermistor 1 exceeds a specified value. When the voltages at the opposite ends of the thermistor 1 do not exceed a specified reference voltage, that is, when the internal resistance of the thermistor 1 does't exceed a specified value, the second comparator 5 outputs low-level.

The transistor 6 also executes a switching operation. When high-level is input into the transistor 6, the transistor 6 makes the collector-emitter conductive. When low-level is input into the transistor 6, the transistor 6 breaks the conduction.

The collector of the transistor 6 is connected to a positive terminal of a power supply. The emitter is connected

to a negative terminal of the power supply, that is, a ground via a coil 7c of a normally-open relay 7.

When the collector-emitter of the transistor 6 is conducted, a current flows from the power supply to the coil 7c of the normally-open relay 7 to close a normally-open contact point 7a. When the conduction is broken, the normally-open contact point 7a is opened.

The collector of the transistor 4 is connected to the power supply via the normally-open contact point 7a and the coil 8c of the normally-open relay 8. The emitter of the transistor 4 is connected to a ground. A power supply voltage is applied to a buzzer 9 via a normally-open contact point 8a of the normally-open relay 8.

When the contact point 7a is closed and the collector-emitter of the transistor 4 becomes conductive, a current flows from the power supply to the coil 8c to close the normally-open contact point 8a. As a result of this, a current flows from the power supply to the buzzer 9 to allow the buzzer 9 to sound. Instead of the buzzer 9, an alarm light may be employed.

Next, the present utility model will be further described including an operation as a whole. The cooling water temperature increases in accordance with the operation time of the engine, and the internal resistance of the thermistor

1 also increases accordingly. As a result, the voltages at the opposite ends of the thermistor 1 also increase.

The valve of the thermostat starts to open when the water temperature is at 70 to 80°C. Therefore, the reference voltage for the second comparator 5 is set to a value equal to the voltages at the opposite ends of the thermistor 1 when the water temperature is at 70 to 80°C or higher, and preferably, is relatively high.

Therefore, when the water temperature in the water path within the engine block exceeds the temperature corresponding to the reference voltage, the second comparator 5 outputs high-level. As a result, a current flows to the coil 7c via the transistor 6 to close the contact point 7a.

Now, in this state, it is assumed that the thermostat is out of order and its valve is left in a closed state.

Since the water path leading to the radiator is blocked, the water temperature in the water path within the engine block at the upstream of the thermostat is higher than the water temperature in the water path leading to the radiator at the downstream of the thermostat.

In accordance with the above situation, the inside resistance of the thermistor 1 becomes higher than the internal resistance of the thermistor 2, and accordingly, a ratio between the internal resistance of the thermistor 1 and the internal resistance of the thermistor 2 also significantly increases.



The values of the resistances R1, R2 are properly set in such a manner that the output from the first comparator 3 switches at a specified ratio between the internal resistances of the thermistors 1, 2 which are achieved when the thermostat is out of order or the like.

Therefore, the first comparator 3 outputs high-level when the water temperature in the water path within the engine block increases to exceed the preset value as compared with the water temperature in the water path leading to the radiator and the ratio between the internal resistance of the thermistors 1, 2 exceeds a specified value.

As a result of this, since the collector-emitter of the transistor 4 becomes conductive and the contact point 7a is advantageously in a closed state, a current flows to the coil 8c. Then, the contact point 8a closes and the buzzer 9 sounds.

As described above, when the thermostat is out of order and the water temperature in the water path within the engine block increases to excessively high value as compared with the water temperature in the water path leading to the radiator, the buzzer 9 sounds. Therefore, a driver is urged to take any countermeasures against overheating, thereby avoiding overheating before it occurs.

By the way, when the water temperature in the water path within the engine block is at a specified value or lower,

the contact point 7a is in an open state. Therefore, the buzzer 9 never sounds even if the ratio between the internal resistance of the thermistors 1, 2 exceeds a specified value.

FIG. 2 shows another embodiment of the present utility model. Contrary to a second comparator, a first comparator 3 is constructed so as to output high-level when the internal resistance of the thermistor 2 is at a specified value or lower which is set beforehand by the resistors R2, R5, R6, that is, when the cooling water temperature at the downstream side of the main valve of the thermostat is at a specified value or lower.

Specifically, the buzzer 9 sounds when both of the first comparator 3 and the second comparator 5 output high-level, that is, the cooling water temperature at the upstream side of the main valve of the thermostat exceeds a specified value and the cooling water temperature at the downstream side of the main valve of the thermostat is at a specified value or lower.

With this arrangement, when the thermostat is out of order and the difference of water temperature between the upstream side and downstream side of the thermostat becomes excessively large, this difference is accurately detected.

As described above, in the present utility model, the thermistor is disposed on the upstream side and downstream side of the thermostat respectively. With this arrangement, an

abnormal state of the thermostat is accurately detected and the driver is urged to take any countermeasures against an excessive increase in the cooling water temperature caused by the failure of the thermostat.

#### Brief description of the drawings

FIG. 1 is a circuit diagram showing an embodiment of the present utility model. FIG. 2 is a circuit diagram showing another embodiment of the present utility model.

1, 2: Thermistor, 3, 5: Comparator, 9: Buzzer

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Title of the Invention

. A thermostat abnormality detecting unit

Claim:

In a circulating passage of cooling water for cooling an engine body, a thermostat abnormality detecting unit comprising: a thermostat interposed in a portion of said circulating passage that interconnects an exit of the circulating passage of cooling water for engine body and a radiator, the detecting unit further comprising: a first temperature sensor disposed upstream of said thermostat; a second temperature sensor disposed downstream of said thermostat; a first comparator for comparing outputs from the first and second temperature sensors; a second comparator for comparing the output from the first temperature sensor with a predetermined reference temperature; and a warning device for giving a warning based on an output from said first comparator,

wherein the warning is issued when said first comparator provides the output in parallel with the output from said second comparator.

#### Brief Description of the drawings

Fig.1 is a circuit diagram showing one embodiment of the present device; and Fig.2 is a circuit diagram showing another embodiment of the device.

1,2: THERMISTERS, 3,5: COMPARATORS, 9: BUZZER

JP-U-55-135983 teaches a thermostat malfunction detecting system. When an engine side coolant temperature rises above a predetermined temperature and a ratio of the internal resistances of thermistors 1 and 2 increases, a first comparator 3 produces a high level output. That is, when a thermostat fails causing the engine side coolant temperature to rise above a radiator side coolant temperature, a buzzer 9 warns a driver to take necessary action for avoiding an engine overheating.